

CLAIMS

1. An amplification process of a reaction between the two elements of a ligand-receptor pair, characterised in that it includes:

- bringing into contact the two elements of the ligand-receptor pair in conditions suitable to allow their reaction, and
- previously, simultaneously or subsequently to this bringing into contact, the application to one and/or the other of these elements of the electromagnetic signal characteristic of the biological activity of one and/or the other of said elements.

2. An amplification process according to claim 1, characterised in that the reaction between the ligand and the receptor is obtained by bringing into contact two reagents containing respectively the ligand and the receptor, and to one and/or the other of these reagents is applied an electromagnetic test signal suspected to include the electromagnetic signal characteristic of the biological activity of this ligand and/or this receptor.

3. An amplification process according to claim 2, characterised in that the application, to one and/or the other of the reagents, of the electromagnetic test signal

is made by exposure of a solution or a suspension containing one or other of these reagents to this electromagnetic signal.

4. An amplification process according to claim 2, characterised in that the application, to one and/or the other of the reagents, of the electromagnetic test signal is made by dilution of a solution or of a suspension including one and/or the other of these reagents, in a solvent having been previously exposed to this electromagnetic signal.

5. An amplification process according to claim 2, characterised in that the application, to one and/or the other of the reagents, of the electromagnetic test signal is made by dissolution or putting into suspension this reagent or these reagents in a solvent having been previously exposed to this electromagnetic signal.

6. An amplification process according to claim 4 or claim 5, characterised in that the solvent having been previously exposed to the electromagnetic signal characteristic of the biological activity of the analysis sample is water or physiological solute.

7. An amplification process according to any one of claims 2 to 6, characterised in that the electromagnetic test signal is the electromagnetic signal picked up from an analysis sample and suspected to contain the ligand and/or the receptor.

8. An amplification process according to any one of claims 2 to 6, characterised in that the electromagnetic test signal is the electromagnetic signal radiated by an electromagnetic radiation source.

9. An amplification process according to claim 1, characterised in that the reaction between the ligand and the receptor is obtained by bringing into contact an

analysis sample suspected to contain the ligand and/or the receptor, with a reagent containing either the receptor, or the ligand, and, to this sample and or to this reagent, is applied the electromagnetic signal characteristic of the biological activity of said ligand and/or said receptor.

10. An amplification process according to claim 9, characterised in that the application, to the analysis sample, of the electromagnetic signal characteristic of the biological activity of the ligand and/or the receptor is made by exposure of this sample to this electromagnetic signal or signals, or by dilution of this sample in a solvent having been previously exposed to said electromagnetic signal or signals.

11. An amplification process according to claim 9 or claim 10, characterised in that the application, to the reagent intended to react with the analysis sample, of the electromagnetic signal characteristic of the biological activity of the ligand and/or the receptor is made by exposure of a solution or a suspension containing this reagent to this electromagnetic signal or signals, or by dilution of such a solution or suspension in a solvent having been previously exposed to this electromagnetic signal or signals, or again by dissolution or putting into suspension of this reagent in a solvent having been previously exposed to said electromagnetic signal or signals.

12. An amplification process according to claim 9, characterised in that, to the analysis sample and to the reagent intended to react with it, is applied the electromagnetic signal characteristic of the biological activity of the ligand and/or the receptor, by exposure of a solution or a suspension containing this sample or this reagent to this electromagnetic signal or signals, or by

dilution of such a solution or suspension in a solvent having been previously exposed to said electromagnetic signal or signals.

5 13. An amplification process according to any one of claims 9 to 12, characterised in that, to the analysis sample and/or to the reagent intended to react with it, is applied both the electromagnetic signal characteristic of the biological activity of the ligand and the electromagnetic signal characteristic of the biological
10 activity of the receptor.

14. An amplification process according to any one of claims 11 to 12, characterised in that the solvent having been previously exposed to the electromagnetic signal or signals is advantageously water or physiological solute.

15 15. An amplification process according to any one of claims 1 to 14, characterised in that it includes an acquisition stage of the electromagnetic signal characteristic of the biological activity of one and/or the other of the elements of the ligand-receptor pair.

20 16. An amplification process according to claim 15, characterised in that it includes a recording and restitution stage of information representative of the electromagnetic signal characteristic of the biological activity of one and/or the other of the elements of the
25 ligand-receptor pair.

17. An amplification process according to any one of claims 1 to 16, characterised in that it includes a detection and, possibly, a measurement stage of the complexes resulting from the reaction between the ligand
30 and the receptor.

18. An amplification process according to any one of claims 1 to 17, characterised in that the ligand is an antigen or a hapten, whereas the receptor is an antibody or

a membranous receptor targeted specifically against this ligand.

18. An amplification process according to claim 16, characterised in that the reaction between the antigen and the antibody or the hapten and the antibody is revealed by agglutination.

19. A process for detecting the presence of a substance corresponding to one of the two elements of a ligand-receptor pair in an analytical sample, characterised in that it includes the implementation of an amplification process according to any one of the claims 1 to 7 and 9 to 19.

20. A detection process according to claim 19, characterised in that it includes:

- 15 - the bringing into contact of two reagents containing respectively the ligand and the receptor, in conditions suitable to allow their reaction,
- previously, simultaneously or subsequently to this bringing into contact, the application, to one and/or the other of these reagents, of the electromagnetic signal characteristic of the biological activity of the analytical sample, and
- 20 - the detection and/or the measurement of the ligand-receptor complexes formed during the reaction between the two reagents.

21. A detection process according to claim 20, characterised in that the concentrations of the ligand and of the receptor are chosen so as to be sufficient to lead to the obtaining of ligand-receptor complexes detectable in the absence of the application of the electromagnetic signal of the biological activity of said sample, but lower than the concentrations likely to lead to a saturation of the reaction between this ligand and this receptor.

23. A detection process according to claim 21, characterised in that it includes:

- the bringing into contact of the analytical sample with a reagent containing either the receptor, if the substance sought in the sample is the ligand, or the ligand, if the substance sought in the sample is the receptor, in conditions suitable to allow their reaction,
- previously, simultaneously or subsequently to this bringing into contact, the application, to this sample and/or this reagent, of the electromagnetic signal characteristic of the biological activity of the ligand and/or the receptor, and
- the detection and/or the measurement of the ligand-receptor complexes possibly formed.

24. A device for detecting the presence of a substance corresponding to one of the two elements of a ligand-receptor pair in an analytical sample, characterised in that it implements a process according to claim 20, and in that it comprises:

- a) reception means (47) of the analytical sample and of a reagent containing either the receptor, or the ligand, allowing them to be brought into contact in conditions suitable to allow their reaction;
- b) an electromagnetic signal source (5, 9, 9', 19) characteristic of the activity of the ligand and/or of the receptor;
- c) application means (51) of the signal delivered by said electromagnetic signal source (5, 9, 9', 19) to the sample and/or the reagent; and
- d) detection and/or measurement means (53, 55, 57) of the ligand-receptor complexes formed during the reaction between the sample and the reagent.

23. A device for detecting the presence of a substance corresponding to one of the two elements of a ligand-receptor pair in an analytical sample, characterised in that it implements a process according to claim 21, and in that it comprises:

- a reception means (47) of the analytical sample and of a reagent containing respectively the receptor and the ligand, allowing them to be brought into contact in conditions suitable to allow their reaction;
- c) acquisition means of an electromagnetic signal of the analytical sample;
- b) application means (51) of the signal delivered by said electromagnetic signal acquisition means (45, 9, 9', 19) to one and/or the other of the reagents; and
- d) detection and/or measurement means (53, 55, 57) of the ligand-receptor complexes formed during the reaction between the two reagents.

24. A device according to claim 24 or claim 25 characterised in that the detection means comprise optical detection means.

25. A device according to any one of claims 24 to 26 characterised in that it comprises an enclosure (13) fitted with an electrical and magnetic shielding surrounding said reception means (47).

26. Application of a process for detecting the presence of a substance in an analytical sample according to any one of the claims 20 to 23 to biological diagnostics in human or veterinary medicine.

27. Application of a process for detecting the presence of a substance in an analytical sample according to any one of the claims 21 to 23 to bacteriological control in the pharmaceutical industry, the cosmetics industry, food production and industries.

31. A process for detecting the presence, in an electromagnetic test signal, of an electromagnetic signal characteristic of the biological activity of a substance corresponding to one of the two elements of a ligand-receptor pair, characterised in that it includes the implementation of an amplification process according to any one of the claims 1 to 8 and 18 to 19.

31. A detection process according to claim 31, characterised in that the electromagnetic signal is the electromagnetic signal radiated by an electromagnetic radiation source.

32. A process for producing or acquiring from a substance (1) signals, particularly electrical signals, characteristic of the biological and/or chemical activity or of the biological and/or chemical behaviour of said substance or of an active element contained in said substance;
said process including the stages:

- of placing said substance in a zone (13) subjected to an excitation field of an electrical, magnetic and/or electromagnetic type (15, 17); said excitation field being produced by an excitation signal having particularly a frequency between 20 Hz and 20 000 Hz;

- of converting the fields resulting from the interaction of the excitation field and the substance, into signals, particularly electrical signals, by means of a first transducer or acquisition sensor (5) receiving said resulting fields,

(said signals are characteristic of the biological and/or chemical activity or of the biological and/or chemical behaviour of said substance or said active element contained in said substance).

33. A process according to claim 32, the characteristic of said excitation signal being that it has a uniform spectral power, of the white noise type.

34. A process according to any one of claims 32 or 33, such that:

- the zone subjected to the excitation field is isolated (13) from the parasitic fields coming from the environment.

35. A process according to any one of claims 32 to 34, further including the stage:

- of applying said signals coming from said first transducer (8), by means of a second transducer (51), to a biological receptor system, (in such a way that the biological and/or chemical activity or the biological and/or chemical behaviour of the biological receptor system will be modified in accordance with the nature of the biological and/or chemical activity or the biological and/or chemical behaviour of said substance).

36. A system for producing or acquiring signals, particularly electrical signals, characteristic of the biological and/or chemical activity or of the biological and/or chemical behaviour of a substance (1) or of an active element contained in said substance and a system for implementing the properties of such signals; said system including:

- an emitter (15, 17) generating an excitation field of an electrical, magnetic and/or electromagnetic type in a zone (13) where said substance is located; said emitter being excited by an excitation signal having particularly a frequency between 20 Hz and 21 000 Hz;

- a first transducer or acquisition sensor (8) receiving fields resulting from the interaction of said

excitation field and said substance, said first transducer converting said resulting fields into signals, particularly electrical signals,

(said signals are characteristic of the biological and/or chemical activity or of the biological and/or chemical behaviour of said substance or said active element contained in said substance).

- emission means particularly a coil 51 for applying said signals coming from said first transducer to a biological receptor system,

(in such a way that the biological and/or chemical activity or the biological and/or chemical behaviour of the biological receptor system will be modified in accordance with the nature of the biological and/or chemical activity or the biological and/or chemical behaviour of said substance).

37. A system according to claim 36, the characteristic of said excitation signal being that it has a uniform spectral power.

38. A system according to any one of the claims 36 or 37, such that it further comprises:

- shielding means (13) to isolate said zone from the parasitic fields coming from the environment.

39. A device for producing or acquiring signals, particularly electrical signals, characteristic of the biological and/or chemical activity or of the biological and/or chemical behaviour of a substance or of an active element contained in said substance; said device including:

- an emitter 15, 17 generating an excitation field of an electrical, magnetic and/or electromagnetic type in a zone 13 where said substance is located; said emitter

being excited by an excitation signal having particularly a frequency between 21 Hz and 21 111 Hz;

- a first transducer or acquisition sensor 8 receiving fields resulting from the interaction of said excitation field and said substance, said first transducer converting said resulting fields into signals, particularly electrical signals,
(said signals are characteristic of the biological and or chemical activity or of the biological and or chemical behaviour of said substance or said active element contained in said substance).

40. A device according to claim 39, the characteristic of said excitation signal being that it has a uniform spectral power.

- 41. A device according to any one of claims 39 or 40, such that it further comprises:

- shielding means 413 to isolate said cone from the parasitic fields coming from the environment.

NEW CLAIMS

- 42. An amplification process of a reaction between the two elements of a ligand-receptor pair, characterised in that it includes:

- bringing into contact the two elements of a ligand-receptor pair in conditions suitable to allow their reaction, and
- previously, simultaneously or subsequently to this bringing into contact, the application to one and/or the other of these elements of an electromagnetic signal, obtained from an electrical signal produced by a sensor placed in front of one and/or the other of the two elements of the ligand-receptor pair; said electromagnetic signal being hereinafter designated the electromagnetic signal

characteristic of the biological activity of one and/or the other of the two elements of a ligand-receptor pair.

43. An amplification process according to claim 42, characterised in that the reaction between the ligand and the receptor is obtained by bringing into contact two reagents containing respectively the ligand and the receptor, and, to one and/or the other of these reagents, is applied an electromagnetic test signal suspected to include the electromagnetic signal characteristic of the biological activity of one and/or the other of the two elements of a ligand-receptor pair.

44. An amplification process according to claim 43, characterised in that the application, to one and/or the other of the reagents, of the electromagnetic test signal is made by exposure of a solution or a suspension containing one or other of these reagents to this electromagnetic signal.

45. An amplification process according to claim 43, characterised in that the application, to one and/or the other of the reagents, of the electromagnetic test signal is made by dilution of a solution or a suspension including one and/or the other of these reagents, in a solvent having been previously exposed to this electromagnetic signal.

46. An amplification process according to claim 43, characterised in that the application, to one and/or the other of the reagents, of the electromagnetic test signal is made by dissolution or putting into suspension of this reagent or these reagents in a solvent having been previously exposed to this electromagnetic signal.

47. An amplification process according to claim 43 or claim 46, characterised in that the solvent having been previously exposed to the electromagnetic test signal is water or physiological saline.

48. An amplification process according to any one of the claims 43 to 47, characterised in that the electromagnetic test signal is the electromagnetic signal obtained from an electrical signal produced by a sensor placed in front of an analysis sample suspected to contain the ligand and/or the receptor.

49. An amplification process according to any one of claims 43 to 47, characterised in that the electromagnetic test signal is the electromagnetic signal radiated by an electromagnetic radiation source.

50. An amplification process according to claim 42, characterised in that the reaction between the ligand and the receptor is made by bringing into contact an analysis sample suspected to contain the ligand and/or the receptor, with a reagent containing either the receptor, or the ligand, and, to this sample and/or to this reagent, is applied the electromagnetic signal characteristic of the biological activity of one and/or the other of the two elements of the ligand-receptor pair.

51. An amplification process according to claim 50, characterised in that the application, to the analysis sample, of the electromagnetic signal characteristic of the biological activity of one and/or the other of the two elements of the ligand-receptor pair is made by exposure of this sample to this electromagnetic signal or signals, or by dilution of this sample in a solvent having been previously exposed to said electromagnetic signal or signals.

52. An amplification process according to claim 50 or claim 51, characterised in that the application, to the reagent intended to react with the analysis sample, of the electromagnetic signal characteristic of the biological activity of one and/or the other of the two elements of the

ligand-receptor pair is made by exposure of a solution or a suspension containing this reagent to this electromagnetic signal or signals, or by dilution of such a solution or suspension in a solvent having been previously exposed to this electromagnetic signal or signals, or again by dissolution or putting into suspension of this reagent in a solvent having been previously exposed to said electromagnetic signal or signals.

53. An amplification process according to claim 51, characterised in that, to the analysis sample and to the reagent intended to react with it, is applied the electromagnetic signal characteristic of the biological activity of one and/or the other of the two elements of the ligand-receptor pair, by exposure of a solution or a suspension containing this sample and this reagent to this electromagnetic signal or signals, or by dilution of such a solution or suspension in a solvent having been previously exposed to said electromagnetic signal or signals.

54. An amplification process according to any one of claims 50 to 53, characterised in that, to the analysis sample and/or to the reagent intended to react with it, is applied both said electromagnetic signal characteristic of the biological activity of the ligand and said electromagnetic signal characteristic of the biological activity of the receptor.

55. An amplification process according to any one of claims 51 to 53, characterised in that the solvent having been previously exposed to the electromagnetic signal or signals is advantageously water or physiological solute.

56. An amplification process according to any one of claims 42 to 55, characterised in that it includes an acquisition stage of the electromagnetic signal

characteristic of the biological activity of one and/or the other of the two elements of the ligand-receptor pair.

57. An amplification process according to claim 54, characterised in that it includes a recording and
5 restitution stage of information representative of the electromagnetic signal characteristic of the biological activity of one and/or the other of the two elements of the ligand-receptor pair.

58. An amplification process according to any one of
10 claims 42 to 57, characterised in that it includes a detection and, possibly, a measurement stage of the complexes resulting from the reaction between the ligand and the receptor.

59. An amplification process according to any one of
15 claims 42 to 58, characterised in that the ligand is an antigen or a hapten, whereas the receptor is an antibody or a membranous receptor targeted specifically against this ligand.

60. An amplification process according to claim 59,
20 characterised in that the reaction between the antigen and the antibody or the hapten and the antibody is revealed by agglutination.

61. A process for detecting the presence of a substance corresponding to one of the two elements of a
25 ligand-receptor pair in an analytical sample, characterised in that it includes the implementation of an amplification process according to any one of the claims 42 to 49 and 50 to 60.

62. A detection process according to claim 61,
30 characterised in that it includes:
- the bringing into contact of two reagents containing respectively the ligand and the receptor, in conditions suitable to allow their reaction,

- previously, simultaneously or subsequently to this bringing into contact, the application, to one and/or the other of these reagents, of an electromagnetic signal obtained from an electrical signal produced by a sensor placed in front of the analytical sample; said electromagnetic signal being hereinafter designated the electromagnetic signal characteristic of the biological activity of the analytical sample, and

- the detection and/or the measurement of the ligand-receptor complexes formed during the reaction between the two reagents.

63. A detection process according to claim 62, characterised in that the concentrations of the ligand and of the receptor are chosen so as to be sufficient to lead to the obtaining of ligand-receptor complexes detectable in the absence of the application of said electromagnetic signal characteristic of the biological activity of the analytical sample, but lower than the concentrations likely to lead to a saturation of the reaction between this ligand and this receptor.

64. A detection process according to claim 61, characterised in that it includes:

- the bringing into contact of the analytical sample with a reagent containing either the receptor, if the substance sought in the sample is the ligand, or the ligand, if the substance sought in the sample is the receptor, in conditions suitable to allow their reaction,

- previously, simultaneously or subsequently to this bringing into contact, the application, to this sample and/or this reagent, of the electromagnetic signal characteristic of the biological activity of one and/or the other of the two elements of the ligand-receptor pair, and

- the detection and/or the measurement of the ligand-receptor complexes possibly formed.

45. A device for detecting the presence of a substance corresponding to one of the two elements of a ligand-receptor pair in an analytical sample, characterised in that it implements a process according to claim 41, and in that it comprises:

- a reception means (47) of the analytical sample and of a reagent containing either the receptor, or the ligand, allowing them to be brought into contact in conditions suitable to allow their reaction;
- b) a source (5, 9, 9', 19) of the electromagnetic signal characteristic of the biological activity of one and/or the other of the two elements of the ligand-receptor pair;
- 15 - c) application means (51) to the sample and/or to the reagent of the electromagnetic signal characteristic of the biological activity of one and/or the other of the two elements of the ligand-receptor pair delivered by said source (5, 9, 9', 19); and
- 20 - d) detection and/or measurement means (53, 55, 57) of the ligand-receptor complexes formed during the reaction between the sample and the reagent.

46. A device for detecting the presence of a substance corresponding to one of the two elements of a ligand-receptor pair in an analytical sample, characterised in that it implements a process according to claim 241, and in that it comprises:

- a reception means (47) of the analytical sample and of a reagent containing respectively the ligand and the receptor, allowing them to be brought into contact in conditions suitable to allow their reaction;
- 30 - b) acquisition means of an electromagnetic signal obtained from an electrical signal produced by a sensor

placed in front of the analytical sample; said electromagnetic signal being hereinafter designated the electromagnetic signal characteristic of the biological activity of the analytical sample, and

- 5 - c application means 51 to one and/or the other of the reagents of said electromagnetic signal characteristic of the biological activity of the analytical sample, and
- d detection and/or measurement means 53, 55, 57 of the ligand-receptor complexes formed during the reaction
- 10 between the two reagents.

67. A device according to claim 65 or claim 66, characterised in that the detection means comprise optical detection means.

- 68. A device according to any one of claims 65 to 67,
- 15 characterised in that it comprises an enclosure (13) fitted with an electrical and magnetic shielding surrounding said reception means (47).

- 69. Application of a process for detecting the presence of a substance in an analytical sample according
- 20 to any one of the claims 60 to 64 to biological diagnostics in human or veterinary medicine.

- 70. Application of a process for detecting the presence of a substance in an analytical sample according
- to any one of the claims 61 to 64 to bacteriological
- 25 control in the pharmaceutical industry, the cosmetics industry, food production and industries.

- 71. A process for detecting the presence, in an electromagnetic test signal, of the electromagnetic signal characteristic of the biological activity of one and/or the
- 30 other of the two elements of a ligand-receptor pair; characterised in that it includes the implementation of an amplification process according to any one of the claims 42 to 49 and 52 to 54.

Figure 3
Generator

Figure 4

- 5 39 :analogue-to-digital converter
- 41 :digital-toanalogue converter
- 35 :video interface
- 31 :controller
- 29 :input/output interface